



**Civilian Radioactive Waste
Management System**

Management & Operating Contractor

Analyses of Alternative Waste Forms

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■ Purpose and scope

- Purpose
- Waste forms assigned
- Areas analyzed
- Deliverables
- Constraints

■ Preclosure safety analysis

■ Postclosure performance assessment

■ In-package geochemistry

■ Postclosure in-package criticality

■ Conclusions

■ Analysis team

Purpose and Scope

- **Purpose -- to evaluate alternative waste forms that EM was considering (to reduce the cost of disposal) and provide RW with a basis for responding to the EM findings**
- **Work assigned by Technical Direction Letter (TDL) on January 15, 2003**
- **Waste forms assigned in the TDL**
 - Aluminum-clad DOE SNF bare or bare in standard canister
 - Additional categories of uncanistered DOE SNF (e.g., ATR, HFIR, etc.)
 - Different HLW borosilicate glass formulations (higher waste loading and frit formulations to accommodate higher waste loading)

Purpose and Scope (Continued)

■ Areas analyzed

- Transportation, regulatory, preclosure safety, postclosure performance, postclosure radionuclide release, postclosure criticality, materials control and accountability, and cost

■ Deliverables

- Work Plan -- January 24, 2003
- Phase one report -- April 11, 2003 -- preliminary screening based primarily on existing analyses
- Phase 2 report -- August 15, 2003 -- detailed preclosure safety analysis, postclosure performance assessment, geochemical analyses, and postclosure in-package criticality analyses

■ Constraints

- Work would minimize the impact on the LA schedule
 - ◆ Require a multi-disciplinary working group
- To meet schedule work would be non-Q scoping analyses

Preclosure Safety Analysis

- **Work indicated that single-phase borosilicate glass with increased waste loading would meet preclosure safety criteria**
 - Single-phase glass (no phase separation) meets the definition of vitric material (amorphous)
 - The requirement for single-phase glass allows the information for the pulverization factor (PULF) to be used
- **Screening of handling of bare aluminum fuels indicated that some fuels might be candidates for bare handling (e.g., some FRR and HFIR)**
 - Preliminary analysis of cost of bare handling (facility and characterization) indicated that bare handling would likely have higher cost
 - Materials control and accountability indicates that it is better to track a single canister than to track all of the pieces individually

Postclosure Performance Assessment

- **Increased waste loading of borosilicate glass increases the dose in proportion to the increased waste content. The increase is insignificant as compared to regulatory limits**
- **Canistered aluminum-based spent fuel (Group 9) will be considered in TSPA-LA**

- **Increased waste loading of Savannah River Site borosilicate glass results in a somewhat lower pH than the 28% waste loaded glass (8.3 to 8.6 as compared to 9.0)**
- **This decrease in pH would have a beneficial effect on neptunium and plutonium solubility**
- **The lowering of pH was not observed for increased waste loading of Hanford Site borosilicate glass**
- **The results from the Hanford Site glass are similar to those of the Savannah River Site glass with 28% waste loading**

Postclosure In-Package Criticality

- Due to the flexibility of adding poisons or reducing the amount of fuel in a standard canister, postclosure in-package criticality may not be an issue with aluminum-based fuels. However, additional criticality analyses will be required to fully address all types of aluminum SNF.
- In-package criticality analyses show that ATR SNF would require a C4 alloy fuel basket design with a plate thickness of 0.375 inches that contains 2 weight percent gadolinium. The canister design for HFIR SNF would require use of aluminum shot with 1 percent gadolinium.

- **There appears to be no reason to exclude canistered aluminum-based spent fuel is from the LA**
- **In order to consider the disposal of single-phase borosilicate glass with the increased waste loading in the LA, a traceable path from the FEPs through the AMRs to the TSPA-LA model is required. In addition, sensitivity analyses of the HLW with increased waste loading would need to be included in the TSPA-LA document.**

- **Lead -- James Duguid**
- **Preclosure safety -- Richard Morissette**
- **Postclosure performance -- Henry Loo & Rainer Senger**
- **Radionuclide release -- Jim Lolcama**
- **Criticality -- Larry Taylor**
- **Transportation -- Steven Schmid**
- **Regulatory -- John Starmer**
- **Policy and review -- Tom Cotton & David Siefken**